CLAIMS

1. A compound semiconductor device comprising:

a hexagonal silicon carbide crystal substrate; and

a boron-phosphide-based semiconductor layer formed on the silicon carbide crystal substrate, wherein

the silicon carbide crystal substrate has a surface assuming a {0001} crystal plane, and

the boron-phosphide-based semiconductor layer is composed of a {111} crystal stacked on and in parallel with the {0001} crystal plane of the silicon carbide crystal substrate, and

when the number of the layers contained in one periodical unit of an atomic arrangement in the [0001] crystal orientation of the silicon carbide crystal substrate is n, an n-layer-stacked structure included in the {111} crystal plane forming the {111} crystal has a stacking height virtually equal to the c-axis lattice constant of the silicon carbide crystal substrate.

2. A compound semiconductor device as recited in claim 1, wherein the {111} crystal forming the boron-phosphide-based semiconductor layer is stacked on the silicon carbide substrate in a line-symmetric manner with respect to the a-axis of the {0001} crystal plane of the silicon carbide crystal substrate.

3. A compound semiconductor device as recited in claim 1, wherein the boron-phosphide-based semiconductor layer is composed of an undoped boron-phosphide-based semiconductor to which an impurity element for controlling the

conduction type has not been intentionally added.

4. A compound semiconductor device as recited in claim 1, wherein the boron-phosphide-based semiconductor layer contains twins each having a {111} crystal plane serving as a twinning plane.

5. A method for producing a compound semiconductor device having a hexagonal silicon carbide crystal substrate and a boron-phosphide-based semiconductor layer formed on the silicon carbide crystal substrate, comprising:

feeding at least a boron-containing compound and a phosphorus-containing compound into a vapor phase growth zone to thereby form a boron-phosphide-based semiconductor layer on a surface of a silicon carbide crystal substrate assuming a {0001} crystal plane serving as a base layer, wherein

the boron-phosphide-based semiconductor layer is composed of a {111} crystal, the crystal being formed on the {0001} crystal plane of the silicon carbide crystal substrate, and when the number of the layers contained in one periodical unit of an atomic arrangement in the [0001] crystal orientation of the silicon carbide crystal substrate is n, an n-layer-stacked structure included in the {111} crystal plane forming the {111} crystal has a stacking height virtually equal to the c-axis lattice constant of the silicon carbide crystal substrate.

6. A method for producing a compound semiconductor device as recited in claim 5, wherein the boron-phosphide-based semiconductor layer is formed at 750°C to 1,200°C.

7. A method for producing a compound semiconductor device as described in

claim 5, wherein the boron-phosphide-based semiconductor layer is formed at a growth rate of 2 nm/min to 30 nm/min.

8. A method for producing a compound semiconductor device as recited in claim 5, wherein the boron-phosphide-based semiconductor layer is formed at a growth rate of 20 nm/min to 30 nm/min in an initial stage of formation of the boron-phosphide-based semiconductor layer.

9. A diode comprising:

a boron-phosphide-based semiconductor layer, serving as a p-type layer or an n-type layer, formed on a {0001} crystal plane of a hexagonal silicon carbide crystal substrate, wherein

the boron-phosphide-based semiconductor layer is composed of a {111} crystal stacked on and parallel to the {0001} crystal plane of the silicon carbide crystal substrate, and

when the number of the layers contained in one periodical unit of an atomic arrangement in the [0001] crystal orientation of the silicon carbide crystal substrate is n, an n-layer-stacked structure included in the {111} crystal plane forming the {111} crystal has a stacking height virtually equal to the c-axis lattice constant of the silicon carbide crystal substrate.